TITLE OF THE INVENTION

DISPLAY APPARATUS AND CONTROL METHOD THEREOF

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of Korean Patent Application No. 2003-55450, filed August 11, 2003, in the Korean Intellectual Property Office, the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0002] The present invention relates to a display apparatus and a control method thereof, and more particularly, to a display apparatus and a control method thereof preventing a screen modulation when identical display data are displayed on a screen over a long period of time.

2. Description of the Related Art

[0003] A display apparatus, for example, a display apparatus used in an airport or a bank, often displays identical data carrying specific character messages over a long period of time at a stationary position on the display apparatus. In such case, a screen modulation occurs due to a physical variation of a displaying component of the display apparatus. For example, if an identical image is displayed on an LCD (liquid crystal display) over the long period of the time, an array of liquid crystals solidifies, making it difficult to display another image.

[0004] To solve such a problem, a method of adding dummy data at each specific frame using a pixel shift, a screen saver, or a scaler was adopted. But, the pixel shift and the screen saver cannot provide a user with information displayed on the screen. Particularly, the pixel shift cannot solve a screen modulation problem when an identical color is displayed within a fixed pixel shift range. Also, the screen may blink when the dummy data are added at each specific frame.

SUMMARY OF THE INVENTION

[0005] Accordingly, it is an aspect of the present invention to provide a display apparatus and a control method thereof providing a user with information displayed on a screen and preventing a screen modulation when identical display data are displayed on the screen.

[0006] Additional aspects and/or advantages of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the invention.

[0007] The foregoing and/or other aspects of the present invention are achieved by providing a display apparatus having: a panel displaying a picture; a panel driver enabling the panel to display the picture; a scaler transferring an input image signal to the panel driver; a key input part generating a color change execution signal for the input image signal by manipulation of a user; and a controller modifying a voltage level value of the input image signal and transferring a modified input image signal to the scaler, if the input image signal transferred to the scaler is identical over a predetermined period of time, after receiving the color change execution signal from the key input part.

[0008] According to an aspect of the invention, the display apparatus also has a storage storing a white voltage level value and a black voltage level value, wherein the controller determines a color reversion value of the input image signal on a basis of the white voltage level value and the black voltage level value stored in the storage to modify the voltage level value of the input image signal and transfer the modified input image signal to the scaler.

[0009] According to another aspect of the present invention, the above and/or other aspects are achieved by providing a control method of a display apparatus having a panel displaying a picture, a panel driver enabling the panel to display the picture, and a scaler transferring an input image signal to the panel driver, the method comprising: generating a color change execution signal from a key input part; checking if the input image signal transferred to the scaler over a predetermined period of time is identical; and modifying a voltage level for the input image signal if the input image signal is transferred to the scaler over the predetermined period of the time is identical.

[0010] According to an aspect of the invention, the control method of the display apparatus further comprises storing a white voltage level and a black voltage level, wherein modifying the voltage level for the input image signal is achieved by determining a color reversion value of the input image signal on a basis of the white voltage level value and the black voltage level value.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The above and/or other aspects and advantages of the present invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings, of which:

FIG. 1 is a block diagram of a display apparatus according to an embodiment of the present invention;

FIG. 2 is a control block diagram of the display apparatus of FIG. 1;

FIG. 3 is an exemplary color reversion of character data displayed on the display apparatus of FIG. 1;

FIG. 4 is a control flow chart of the display apparatus of FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012] Reference will now be made in detail to the embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout. The embodiments are described below to explain the present invention by referring to the figures.

[0013] As illustrated in FIGS. 1 and 2, a display apparatus according to an embodiment of the present invention comprises a panel 25 displaying a picture, a panel driver 23 enabling the panel 25 to display the picture, a scaler 19 receiving a scaler image input signal, and transferring a panel driver input image signal to the panel driver 23, a controller 21, a key input part 27 generating a color change execution signal according to manipulation by a user, and a storage 29 storing a white voltage level value and a black voltage level value.

[0014] If an input image signal is an analog RGB-signal, the analog RGB-signal is transferred to an A/D converter 15 through a D-SUB connector 11. The A/D converter 15 converts the

analog RGB-signal into a digital RGB-signal and transfers the digital RGB-signal to the scaler 19. In this case, the digital RGB-signal transferred by the A/D converter 15 is the scaler input image signal. If the input image signal is a digital signal, the digital signal is transferred to a TMDS part 17 through a DVI connector 13. The TMDS part 17 converts the digital signal into the digital RGB-signal and transfers the digital RGB-signal to the scaler 19. In this case, the digital RGB-signal transferred by the TDMS part 17 is the scaler input image signal.

[0015] A color of the picture displayed on the panel 25 is displayed by a voltage level adjustment of RGB-signals on a basis of the white voltage level value and the black voltage level value. Although the white voltage level value and the black voltage level value vary according to each kind of the display apparatus, the black voltage level value and the white voltage level value generally are configured to be about 0.1V and about 0.7V, respectively, for an LCD monitor. Accordingly, the color of the picture is displayed by each voltage level adjustment of the RGB-signals between about 0.1V and about 0.7V.

[0016] If the scaler input image signal transferred to the scaler 19 is identical over a predetermined period of time since the controller 21 received the color change execution signal from the key input part 27, the controller 21 modifies a voltage level value of the scaler input image signal and transfers the modified scaler input image signal to the scaler 19. In other words, if the scaler input image signal remains unchanged over a predetermined period of time, the controller modifies the voltage level value of the scaler input image signal. Accordingly, the color of the picture displayed on the panel 25 is changed.

[0017] Here, the controller 21 determines a color reversion value of the scaler input image signal on a basis of the white voltage level value and the black voltage level value stored in the storage 29, to modify the voltage level value of the scaler input image signal.

[0018] Determining the color reversion value refers to replacing the color of the picture displayed on the panel 25 with a corresponding complementary color. The idea of complementary colors refers to two colors becoming an achromatic color, such as the white or the black, when mixed in a proper ratio. For example, if a primary color and a secondary color become the white or the black when mixed properly, the complementary color of the primary color is the secondary color, and conversely, the complementary color of the secondary color s the primary color.

[0019] As an example, in the display apparatus having 0.1V and 0.7V as the black voltage level and the white voltage level, respectively, the sum of both voltage levels for the colors that are the complementary color to each other becomes 0.8V. Accordingly, if the present voltage level of an R-signal is 0.2V, the color reversion value becomes 0.6V, acquired by subtracting 0.2V from 0.8V. For a G-signal and a B-signal, respective color reversion values for the present voltage level can be decided in the same manner.

[0020] Accordingly, as illustrated in FIG. 2, if the color change execution signal for the input image signal is generated according to the manipulation by the user and transferred to the controller 21, the controller 21 checks if the scaler input image signal that has been transferred to the scaler 19 is identical (or unchanged) over the predetermined period of the time.

[0021] If so, the controller 21 modifies each voltage level value for the RGB-signals, and transfers the modified scaler input image signal to the scaler 19.. Herein, the controller 21 determines the color reversion value of the input image signal on a basis of the black voltage level value and the white voltage level value stored in the storage 29, to modify the voltage level value for the scaler input image signal.

[0022] The scaler 19 transfers the scaler input image signal having the modified voltage level value to the panel driver 23 as the panel driver input image signal, and the panel driver 23 displays the picture on the panel 25 according to the panel driver input image signal.

[0023] Accordingly, as illustrated in FIG. 3, if the controller 21 receives the color change execution signal from the key input part 27, and if an identical black character image on a white background is displayed over the predetermined period of the time, the color reversion occurs, thereby converting the white into the black and the black into the white. As a result, the black character image on the white background turns into a white character image on a black background.

[0024] Hereinbelow, a control flow 400 of the display apparatus according to an embodiment of the present invention will be described with reference to FIG. 4.

[0025] In operation S11, the storage 29 stores the white voltage level value and the black voltage level value as a criterion of the voltage levels for the RGB-signals. Although the voltage levels vary according to the kinds of the display apparatus, the LCD monitor generally uses 0.1V

and 0.7V as the black voltage level and the white voltage level, respectively. Also, the color of the picture is displayed by each voltage level adjustment of the RGB-signal between 0.1V and 0.7V.

[0026] In operation S13, the image signal inputted through the D-SUB connector 11 or the DIV connector 13 is transferred as the scaler input image signal to the scaler 19. In operation S15, if the color change execution signal for the input image signal is generated by the key input part 27 and transferred to the controller 21, then the controller 21 checks if the identical scaler input image signal has been transferred to the scaler 19 (in other words, if the scaler input image signal has remained the same) over the predetermined period of the time in operation S17.

[0027] In operation S15, if the controller 21 has not received the color change execution signal, then the control flow 400 ends. If, in operation S17, the identical scaler input image signal has not been transferred to the scaler 19 over the predetermined period, then the controller continues to check until the identical scaler input image has been transferred to the scaler 19 over the predetermined period of time.

[0028] In operation S19, if the identical scaler input image signal has been transferred to the scaler 19 over the predetermined period of the time, the controller 21 determines the color reversion value of the scaler input image signal on the basis of the black voltage level value and the white voltage level value stored in the storage 29, to modify the voltage level value for the scaler input image signal.

[0029] The scaler 19 transfers the scaler input image signal having the modified voltage level value to the panel driver 23 as the panel driver input image signal, and then the panel driver 23 displays the picture on the panel 25 according to the panel driver input image signal in operation S21.

[0030] As described, the embodiment of the present invention provides the display apparatus and the control method thereof, providing the user with the information displayed on the screen and preventing the screen modulation when the identical display data are displayed on the screen over the long period of the time.

[0031] Although a few embodiments of the present invention have been shown and described, it will be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles and spirit of the invention, the scope of which is defined in the claims and their equivalents.